

## ACCIDENT INVESTIGATION

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INTRODUCTION

I am certain that everyone shares the interest of the National Transportation Safety Board (NTSB) in reducing our accident investigation workload. The NTSB is not, in the classical sense, a user of wind shear data. We have no R&D capability, no simulators, and very little technical capability in our organization to do in-depth analyses. However, even before the JAWS Project began, we managed to develop some reasonably good wind shear models that have been used to improve pilot training programs by using some of the accident investigation data which came from flight recorders. Many people in the industry have helped us with this considerably. We were very happy to see the JAWS Project get under way so that we could improve upon that data base. We certainly join the rest of the aviation community in our desire to ensure that the data base is used to its maximum advantage to improve safety.

We are assured that wind shear has been around forever. However, we really didn't focus in on the wind shear problem until the early 1970's, although many accidents occurred before that time which were attributed to thunderstorm penetration and other types of weather phenomena (just different names for the wind shear environment). There may be a reason that wind shear has received more attention since the early 1970's. I think that with the advent of higher speed, higher wing-loaded aircraft, along with the better instrument capability of both the airplane and ground navigational aids, the chance of a wind shear encounter is much greater today than it was several years ago. We have more planes flying into poor weather. They are designed to do that; in addition, the airplane itself might be more critical to the wind shear encounter.

NTSB has attributed wind shear as a cause or contributing factor in 15 accidents involving transport-category airplanes since 1970. Nine of these were nonfatal; but the other six accounted for 440 lives. Five of the fatal accidents and seven of the non-fatal accidents involved encounters with convective downbursts or microbursts. Of other accidents, two which were non-fatal were encounters with a frontal system shear, and one which was fatal was the result of a terrain-induced wind shear.

The actions have stressed, first and foremost, the avoidance of wind shear encounters; and, secondly, the actions needed to help a pilot get through it if he encounters wind shear. I believe that one of the major objectives of this workshop is to address how the JAWS data can be used to develop models for the certification of aircraft systems and pilot training. We totally support these efforts, but feel that we must also address the need to learn how to use the data obtained from JAWS to improve forecasting and for development of real-time detection of the hazard threat. I think we also need to address the fact that even if and when we get optimum airport instrumentation, such as terminal microwave Doppler radar, we have a lot of work

to determine how to introduce the data provided from that system into the pilot's decision-making loop. This is still a cause for very much concern. Even more importantly, how can we more effectively use the LLWSAS? Can we use the JAWS data to identify a hazards threat from the LLWSAS so that it can be communicated in a meaningful way to the pilot?

I cannot ignore the fact that it has been nine years since Eastern 66 in New York; and nearly two years now since the Pan Am accident in New Orleans. But today, given the same circumstances, I'm not sure that the same accident couldn't happen. Let's hope it doesn't. Keep in mind that despite the amount of progress we can claim during the last two years, I don't know that there have been any real, firm actions that could have changed the situation as it occurred in New Orleans in July of 1982.

We totally support the use of the JAWS data for developing practical models of the microburst for system certification purposes and training. We are aware, however, that more efforts need to be conducted to determine how complex or sophisticated these models have to be. I agree with many people who have indicated that they believe the FAA should take the lead here, but they need industry help. The FAA does have to stay very much a part of these efforts, and they must define the model so that everyone is working toward the same goal, at least in system certification.

At any rate, we already know the types of flight directors and autoflight logic which need to be developed and implemented in order to optimize the airplane's performance in the case of a wind shear or microburst encounter. We have had, for some time, sufficient knowledge of the general characteristics of the downburst and outflow to identify how the logic of the current systems needs to be changed. Even more importantly, we have to identify the systems that are presently in use, and will remain in use for several years to come, which do not incorporate the optimum logic in order to tell a pilot when he might have to disregard what he has learned in the past in order to take some rather strange evasive action. I know there are efforts under way to do this, but I'm not sure they are quite as systematic as we would like to see.

That brings me to the training aspect. We have a lot of concern from the point that I'm afraid we tend to place too much emphasis on simulator models in training. There is certainly a need to demonstrate to the pilot what happens to his airplane when encountering a microburst; but there is only so much time in which to do this, and only so many encounters can be demonstrated, and they are not all the same. The condition of the encounter during the approach on the ILS glidepath is not the same as the encounter during departure or takeoff. One encounter which interests me very much because it resulted in an accident is the Allegheny DC-9 in Philadelphia, where the airplane actually encountered the outflow of a microburst/downburst beyond the touchsown point along the runway. It was located at the departure end of the runway which the aircraft was approaching. In this particular case, the airplane was in trouble before it ever reached the center of the disturbance. The airspeed built up as a result of running into the outflow; the airspeed didn't bleed off, and the airplane didn't land. The pilot saw that he was long and fast over a wet runway, and he initiated a go-around which put him right in the middle of it.

We certainly need reasonable fidelity in the simulations. For example, we need to demonstrate what kind of control forces the pilot might be confronted with then he takes some of these radical actions. This probably reflects one of the biggest uses of the simulator. We also have to demonstrate the need to rapidly add thrust if the pilot is in a position where he has available thrust to add. Even though we get good academic models, we need to augment the simulator work to actually teach the pilot the fundamentals of what is happening to his airplane during wind shear encounters to prepare him in any phase of flight.

I certainly hope that the large emphasis on the microburst and its phenomenon as a result of the JAWS Project does not lead us to ignore the frontal system shear, which is probably not as dangerous from the significance of the winds, but has caused accidents. The Iberia DC-10 accident in Boston in 1972, although non-fatal, could very easily have resulted in the loss of a wide-bodied airplane full of people. We need to develop a syllabus which treats both the microburst and the frontal system shear. We need to tell pilots how to recognize when either condition might exist and how to avoid it. It is evident to us that there is a need to eliminate bad information which is currently in the training syllabus.

The NTSB is currently investigating two accidents. One is the Flying Tigers DC-8 which landed at Navy Norfolk in October of 1983; the other is the SAS DC-10 which landed at JFK in February 1984. It may not be possible to point to wind shear as a primary cause of either of these accidents; however, in both cases, the pilot was aware that the possibility of wind shear existed. A wind shear did, in fact, exist in the SAS case, but the pilots apparently misunderstood what they should have done for that type of wind shear. In both cases, wind shear to the pilots meant, "Hey, I better add enough speed to compensate in case I run into something on this approach." As it turned out, they added speed but didn't bleed it off; in both cases, the airplanes landed long and fast. In one case, it was on a flooded runway that resulted in a hydroplaning aspect; in the other, there was just too little runway left in which to stop.

In summary, I would like to note that someone has to take the lead to ensure the continuity of a systematic program to coordinate all the activities being conducted on the wind shear problem. However, I feel that the FAA will need the continuing support and input from the R&D organization; i.e., academia, industry, and airframe and systems manufacturers. Furthermore, many recommendations have been made by both the Safety Board and the National Academy. It is important to note that after a National Academy study is completed and their report is released, that report remains on a bookshelf with no one around to pull it off and relate what has happened. That is one reason we are so encouraged by the formation of this ad hoc committee. Although it may be beyond the scope of their charter, I believe it would be well to consider keeping this committee intact to convene periodically to discuss what actions are being taken to implement the Academy recommendations, and to exchange information relative to what is happening in industry.

I also feel that this ad hoc committee could be very useful in, perhaps, communicating the needs to the carriers: i.e., to define the hazard threat;

to determine the communication means to alert the pilot of a possible wind shear condition (or a real-time detection of one), encouraging him to make a decision to not penetrate it on that basis; to improve the on-board systems, both the flight director and automatic flight control systems (and we certainly subscribe to the thought that an automatic flight control might be an answer to the problem); and to continue to emphasize the improvement of training.